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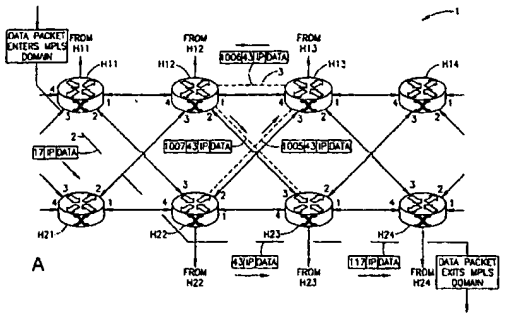
(54) Title: REROUTING IN A MULTIPROTOCOL LABEL SWITCHING (MPLS) DOMAIN



B

TO	INBOUND I/F	INBOUND LBL	IP ADDRESS	OUTBOUND I/F	OUTBOUND LBL	BPS I/F	BPS LBL
H11	-	-	189.29.74.08	2	17	-	-

TO	INBOUND I/F	INBOUND LBL	IP ADDRESS	OUTBOUND I/F	OUTBOUND LBL	BPS I/F	BPS LBL
H12	1	1006	-	2	1007	-	-

TO	INBOUND I/F	INBOUND LBL	IP ADDRESS	OUTBOUND I/F	OUTBOUND LBL	BPS I/F	BPS LBL
H13	3	1005	-	4	1006	-	-

TO	INBOUND I/F	INBOUND LBL	IP ADDRESS	OUTBOUND I/F	OUTBOUND LBL	BPS I/F	BPS LBL
H22	3	17	-	1	43	2	1005

TO	INBOUND I/F	INBOUND LBL	IP ADDRESS	OUTBOUND I/F	OUTBOUND LBL	BPS I/F	BPS LBL
H23	4	43	-	1	117	-	-
	3	1007	-	-	-	-	-

TO	INBOUND I/F	INBOUND LBL	IP ADDRESS	OUTBOUND I/F	OUTBOUND LBL	BPS I/F	BPS LBL
H24	4	117	-	-	-	-	-

(57) Abstract: For use in a Multi-Protocol Label Switching (MPLS) domain, a method for forwarding a data packet including the steps of: (a) establishing a label switched path between a pair of distinct endpoint network elements of a plurality of at least two network elements, the label switched path including one or more protected path segments each defined between a source network element and a destination network element, each protected path segment being one of either a protected link path segment for protecting a link between neighboring source and destination network elements or a protected intermediate network element path segment for protecting an intermediate network element sandwiched between otherwise neighboring source and destination network elements; (b) establishing a backup path segment per protected path segment excluding any shared resource therewith except for its source and destination network elements; and (c) on arrival of a data packet at a source network element of a backup path segment along the label switched path, selectively rerouting the data packet along the backup path segment to its associated destination network element instead of along its associated protected path segment whereupon on arrival thereat ostensibly from its neighboring downstream network element along the label switched path, the data packet proceeds along the label switched path.

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REROUTING IN A MULTIPROTOCOL LABEL SWITCHING (MPLS) DOMAIN

Field of the Invention

The invention relates to the forwarding of a data packet within a Multiprotocol Label Switching (MPLS) domain.

Background of the Invention

Multiprotocol Label Switching (MPLS) is an evolving IETF standard based on the concept of label switching for the forwarding of data packets along a predetermined Label Switched Path (LSP) established between two endpoint network elements. A recent IETF Internet Draft entitled *"A Method For Setting An Alternative Label Switched Paths to Handle Fast Reroute"* by D. Haskin et al, published May 2000, (hereinafter referred to as the Draft) proposes the establishment of a backup LSP between the endpoint network elements of a protected LSP to overcome traffic problem along the protected LSP.

Summary of the Invention

In accordance with the present invention, there is provided for use in a Multiprotocol Label Switching (MPLS) domain, a method for forwarding a data packet comprising the steps of:

(a) establishing a label switched path between a pair of distinct endpoint network elements of a plurality of at least two network elements, the label switched path including one or more protected path segments each defined between a source network element and a destination network element, each protected path segment being one of either a protected link path segment for protecting a link between neighboring source and destination network elements or a protected intermediate network element path segment for protecting an intermediate network element

sandwiched between otherwise neighboring source and destination network elements;

(b) establishing a backup path segment per protected path segment excluding any shared resource therewith except for its source and destination network elements; and

(c) on arrival of a data packet at a source network element of a backup path segment along the label switched path, selectively rerouting the data packet along the backup path segment to its associated destination network element instead of along its associated protected path segment whereupon on arrival thereat ostensibly from its neighboring downstream network element along the label switched path, the data packet proceeds along the label switched path.

Generally speaking, the present invention is based on the notion that a congested or inoperative link between a pair of neighboring network elements of a label switched path, or a congested or inoperative network element itself, is a local problem which can be solved by a local *"fix"*, namely, a so-called Backup Path Segment (BPS) without the trouble of having to define an entirely new LSP as proposed in the above mentioned Draft. In a sense, an BPS can be considered to be an intra MPLS domain Label Switched Path (LSP) in that it has source and destination network elements comparable to an LSP's ingress and egress network elements, the difference being that an BPS is selectively invoked at its source network element and terminates at its destination network element whereupon a data packet rerouted along the BPS proceeds along the original LSP ostensibly as if the data packet had arrived at the destination network element from its neighboring downstream network element. The present invention is particular advantageous in that it enables the convenient adding or modification to BPSs to LSPs as the need may arise, for example, in response to a modification in a network's topology. Similarly, the present invention enables the subsequent removal of redundant BSPs in a convenient fashion. Against that, once an BPS has been invoked, the forwarding of a data

packet along an LSP via an BPS may not necessarily be an optimal route from the LSP's ingress network element to its egress network element in terms of a metric such as shortest route, least cost path, and the like. Along these lines, application of the present invention may even involve the sending of a data packet backwards and forwards along the same link in particular network topologies.

Brief Description of the Drawings

In order to understand the invention and to see how it can be carried out in practice, preferred embodiments will now be described, by way of non-limiting examples only, with reference to the accompanying drawings, in which similar parts are likewise numbered, and in which:

Fig. 1A is a pictorial representation showing the forwarding of a data packet along a Label Switched Path (LSP) within an MPLS domain employing a global label scheme, and the rerouting of the data packet along a Backup Path Segment (BPS) around a protected link path segment of the LSP in accordance with the present invention;

Fig. 1B shows the label switching tables of the network elements involved in the forwarding of the data packet along the LSP and the BPS of Figure 1A;

Fig. 2A is a pictorial representation showing the rerouting of the data packet along a Backup Path Segment (BPS) around a protected intermediate network element path segment of the LSP of Figure 1A in accordance with the present invention;

Fig. 2B shows the label switching tables of the network elements involved in the forwarding of the data packet along the LSP and the BPS of Figure 2A;

Fig. 3A is a pictorial representation showing the forwarding of a data packet along a label switched path (LSP) within an MPLS domain employing a local label scheme, and the rerouting of the data packet along a Backup Path

Segment (BPS) around a protected link path segment of the LSP in accordance with the present invention;

Fig. 3B shows the label switching tables of the network elements involved in the forwarding of the data packet along the LSP and the BPS of Figure 3A;

Fig. 4A is a pictorial representation showing the rerouting of the data packet along a Backup Path Segment (BPS) around a protected intermediate network element path segment of the LSP of Figure 3A in accordance with the present invention; and

Fig. 4B shows the label switching tables of the network elements involved in the forwarding of the data packet along the LSP and the BPS of Figure 4A.

Detailed Description of the Drawings

Figure 1A shows a regular partial mesh MPLS domain 1 including network elements H11, H12, H13, H14, H21, H22, H23 and H24 which is capable of supporting one or more Label Switched Paths (LSPs) for forwarding data packets between any two distinct endpoint network elements, possibly via one or more core network elements. Each pair of neighboring network elements in an upstream direction along an LSP starting at its ingress network element can also double respectively as the source and destination network elements of a Backup Path Segment protecting the link between its network elements. Each network element has a label switching table (LST) enabling the establishment of an LSP, and one or more BSPs associated therewith, if any. Each LST is divided into four columns, namely, an IP Address column specifying IP address values, and three columns each specifying interface (I/F) and label (LBL) values, namely, an Inbound column, an Outbound Column, and a Backup Path Segment (BPS) column. The MPLS domain 1 employs a so-called global label scheme for the forwarding of data packets, namely, each outbound label employed for forwarding a data packet along a link between a pair of neighboring network elements is unique within the MPLS domain.

Figure 1A shows an exemplary LSP 2 (dot dash line) constituted by an ingress network element H11, two core network elements H22 and H23, and an egress network element H24. The LSP 2 has a single backup path segment BPS 3 (dash line) for bypassing the H22-H23 protected link path segment, the BPS 3 being constituted by source network element H22, core network element H13, core network element H12, and destination network element H23. It should be noted that an alternate BPS for the H22-H23 protected link path segment could be via core network elements H13 and H14 whilst the LSP 2 could be provided with additional BPSs for rerouting around two other possible protected link path segments, namely, the H11-H21 link, and the H23-H24 link.

The LSP 2 is allocated MPLS LBL 17 for forwarding a data packet from network element H11 along interface I/F 2 to network element H22, MPLS LBL 43 for forwarding a data packet from network element H22 along interface I/F 1 to network element H23, and MPLS LBL 117 for forwarding a data packet from network element H23 along interface I/F 1 to network element H24. The BPS 3 is allocated MPLS LBL 1005 for forwarding a data packet from network element H22 along interface I/F 2 to network element H13, MPLS LBL 1006 for forwarding a data packet from network element H13 along interface I/F 4 to network element H12, and MPLS LBL 1007 for forwarding a data packet from network element H12 along interface I/F 2 to network element H23.

Propagation of a data packet having an IP destination address 289.29.74.08 along the LSP 2 via BSP 3 is as follows:

The data packet arrives at network element H11 where its IP destination address is matched with LSP 2. Network element H11 encapsulates the data packet with an MPLS header having an MPLS label 17 before forwarding the encapsulated data packet to network element H22 via the interface I/F 2. The data packet arrives at network element H22 at which the BPS 3 has been invoked, for example, due to congestion along the H22-H23 link. The network element H22 switches the MPLS label 17 with the MPLS label 43 and then pushes on an additional MPLS label 1005 onto the MPLS label 43 before

forwarding the rerouted data packet to network element H13 via the interface I/F 2. The rerouted data packet arrives at network element H13 which switches the uppermost MPLS label 1005 with the MPLS label 1006 before forwarding the rerouted data packet to network element H12 via the interface I/F 4. The network element H12 switches the uppermost MPLS label 1006 with the MPLS label 1007 before forwarding the rerouted data packet to network element H23 via the interface I/F 2. The rerouted data packet arrives at network element H23 which pops off the last-in uppermost MPLS label 1007 from the rerouted data packet's MPLS header to reveal the last but one MPLS label 43 of the BPS's source network element H22. The network element H23 then switches the now uppermost MPLS label 43 with the MPLS label 117 before forwarding the now back on track data packet to network element H24 via the interface I/F 1. The now back on track data packet arrives at network element H24 which pops off the uppermost MPLS label 117 from the data packet's MPLS header to reveal the IP destination address 289.29.74.08 whereupon the network element H24 forwards the data packet to this address.

The protection of the H22-H23 link can alternatively be achieved by way of an BPS 4 bypassing a protected intermediate network element path segments between network element H11 and network element H23 (see Figure 2). Alternatively, the H22-H23 link can be protected by an BPS bypassing a protected intermediate network element path segment between network element H22 and network element H24. The manner of rerouting a data packet along BPS 4 is similar to the manner of rerouting around BPS 3, the difference being that the rerouted data packet's MPLS header must necessarily include the MPLS LBL of the intermediate network element H23 between the source network element H22 and the destination network element H24 as opposed to that of the source network element H22 in the case of BPS 3. To this end, each network element's LST includes an additional INT sub-column under its BPS column which stores these values which are pushed onto the MPLS stack of a data packet's MPLS header at a source network element on invoking an BPS

thereat. Thus, in the case of BPS 4, the data packet propagates therealong with the stacked MPLS label 117.

Figures 3A and 4A are respectively comparable to Figures 1A and 2A except that they show an MPLS domain 5 employing a local label scheme where each outbound label for forwarding a data packet along a link between a pair of neighboring network elements is specific for that link only and therefore the same numerical value of an outbound label will, in most likelihood, also be allocated on other links within the same MPLS domain. This is evidenced in the MPLS label employed for forwarding a data packet along LSP 2 from network element H22 to network element H23 has the same value as that employed from network element H11 to network element H22. As a consequence, each destination network element of a protected path segment necessarily requires additional information for associating a popped up MPLS label with its ostensibly originating network element, namely, its neighboring downstream network element. This is achieved in both cases of a protected link path segment (see Figure 3A) or a protected intermediate network element path segment (see Figure 4A) by way of an additional Associated Interface sub-column AI/F to the BPS column of a network element's LST. The additional information in the case of the MPLS domain 5 is evidenced by the value 4 in the AI/F sub-column of the rows of the network elements' LSTs acting as the destination network elements of the BPSs 3 and 4.

While the invention has been described with respect to a limited number of embodiments, it will be appreciated that many variations, modifications, and other applications of the invention can be made within the scope of the appended claims. For example, the present invention can be equally applied to other MPLS domain topologies including ring, mesh, and the like. Also, an LSP can have a combination of one or more protected link path segments and one or more protected intermediate network elements path segments. And, different BPSs can be established for the same protected path segment of different LSPs, if at all.

Claims:

1. For use in a Multi-Protocol Label Switching (MPLS) domain, a method for forwarding a data packet comprising the steps of:

(a) establishing a label switched path between a pair of distinct endpoint network elements of a plurality of at least two network elements, the label switched path including one or more protected path segments each defined between a source network element and a destination network element, each protected path segment being one of either a protected link path segment for protecting a link between neighboring source and destination network elements or a protected intermediate network element path segment for protecting an intermediate network element sandwiched between otherwise neighboring source and destination network elements;

(b) establishing a backup path segment per protected path segment excluding any shared resource therewith except for its source and destination network elements; and

(c) on arrival of a data packet at a source network element of a backup path segment along the label switched path, selectively rerouting the data packet along the backup path segment to its associated destination network element instead of along its associated protected path segment whereupon on arrival thereat ostensibly from its neighboring downstream network element along the label switched path, the data packet proceeds along the label switched path.

2. The method according to claim 1 wherein step (c) includes the steps of

(c11) pushing an MPLS label onto an MPLS stack of the data packet at the source network element prior to forwarding the data packet along the backup path segment, the MPLS label normally being employed for forwarding the data packet from the neighboring downstream network element to the destination network element along the protected path segment; and

(c12) popping the last but one MPLS label from the MPLS stack of the data packet at the destination network element for forwarding the data packet along the label switched path.

3. The method according to claim 2 wherein step (c12) includes associating the popped MPLS label with either the source network element in the case of a protected link path segment or the intermediate network element in the case of a protected intermediate network element path segment.

4. The method according to any one of claims 1 to 3 wherein different BPSs are established for the same protected path segment of different LSPs.

5. For use in a Multi-Protocol Label Switching (MPLS) domain, a telecommunication network for forwarding a data packet, the telecommunication network comprising at least two network elements, and having a label switched path between a pair of distinct endpoint network elements of said at least two network elements, said label switched path including one or more protected path segments each defined between a source network element and a destination network element, each protected path segment being one of either a protected link path segment for protecting a link between neighboring source and destination network elements or a protected intermediate network element path segment for protecting an intermediate network element sandwiched between otherwise neighboring source and destination network elements; and a backup path segment per protected path segment excluding any shared resource therewith except for its source and destination network elements, the arrangement being such that on arrival of a data packet at a source network element of a backup path segment along the label switched path, the data packet is selectively

rerouted along the backup path segment to its associated destination network element instead of along its associated protected path segment whereupon on arrival thereat ostensibly from its neighboring downstream network element along said label switched path, the data packet proceeds along said label switched path.

6. The network according to claim 5 wherein an MPLS label is pushed onto an MPLS stack of the data packet at said source network element prior to forwarding the data packet along said backup path segment, said MPLS label normally being employed for forwarding the data packet from said neighboring downstream network element to said destination network element along said protected path segment; and said last but one MPLS label is popped from said MPLS stack of the data packet at said destination network element for forwarding the data packet along said label switched path.

7. The network according to claim 6 wherein the popped MPLS label is associated with either the source network element in the case of a protected link path segment or the intermediate network element in the case of a protected intermediate network element path segment.

8. The network according to any one of claims 5 to 7 wherein different BPSs are established for the same protected path segment of different LSPs.

9. For use in a Multi-Protocol Label Switching (MPLS) domain, a network element for use in a telecommunication network for forwarding a data packet, the telecommunication network comprising at least two network elements, and having a label switched path between a pair of distinct endpoint network elements of said at least two network elements, said label switched path including one or more protected path segments each

defined between a source network element and a destination network element, each protected path segment being one of either a protected link path segment for protecting a link between neighboring source and destination network elements or a protected intermediate network element path segment for protecting an intermediate network element sandwiched between otherwise neighboring source and destination network elements; and a backup path segment per protected path segment excluding any shared resource therewith except for its source and destination network elements, the arrangement being such that on arrival of a data packet at a source network element of a backup path segment along the label switched path, the data packet is selectively rerouted along the backup path segment to its associated destination network element instead of along its associated protected path segment whereupon on arrival thereat ostensibly from its neighboring downstream network element along said label switched path, the data packet proceeds along said label switched path.

10. The network element according to claim 9 wherein an MPLS label is pushed onto an MPLS stack of the data packet at said source network element prior to forwarding the data packet along said backup path segment, said MPLS label normally being employed for forwarding the data packet from said neighboring downstream network element to said destination network element along said protected path segment; and said last but one MPLS label is popped from said MPLS stack of the data packet at said destination network element for forwarding the data packet along said label switched path.

11. The network element according to claim 10 wherein the popped MPLS label is associated with either the source network element in the case of a protected link path segment or the intermediate network element in the case of a protected intermediate network element path segment.

12. The network element according to any one of claims 9 to 11 wherein different BPSs are established for the same protected path segment of different LSPs.

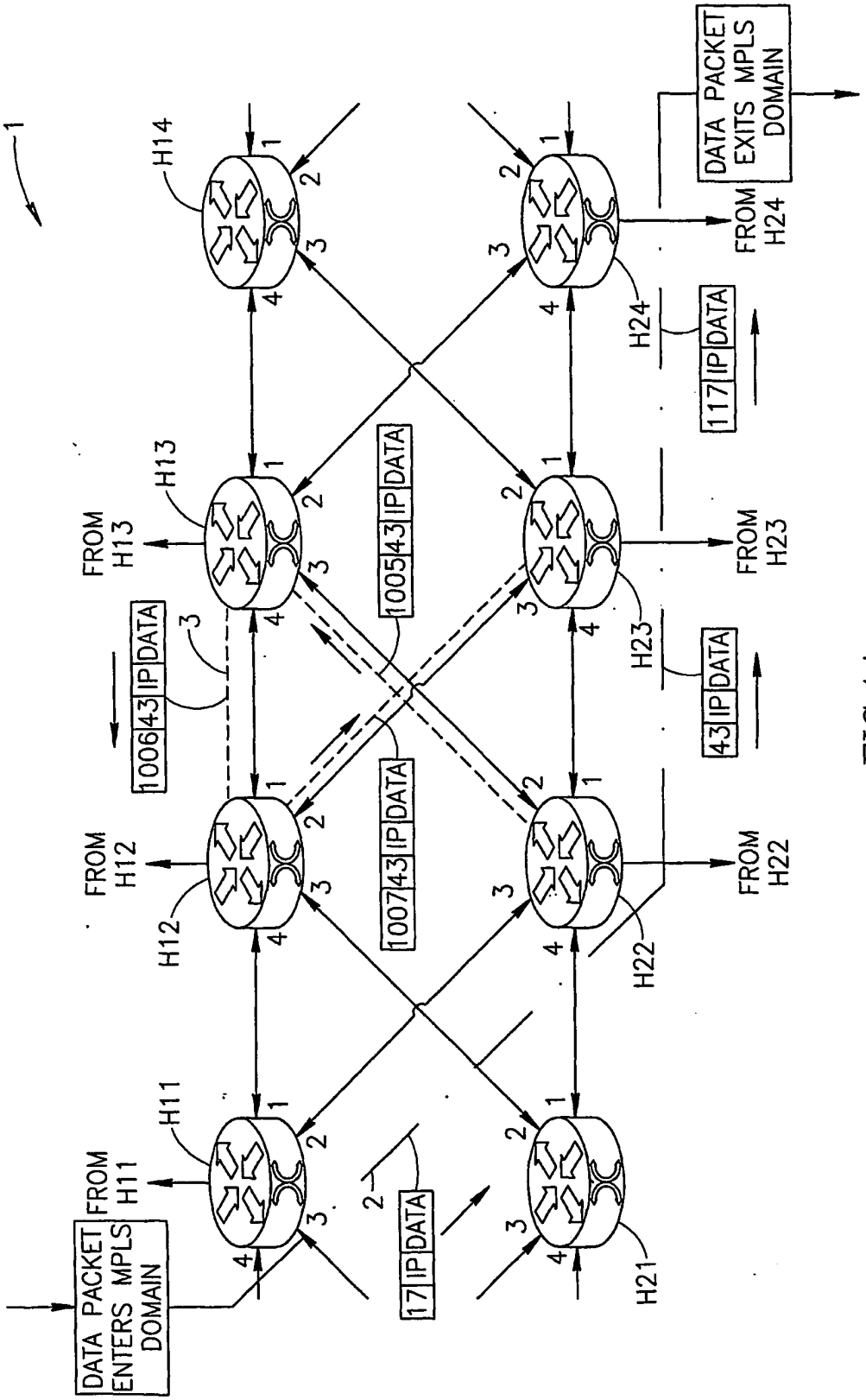
1
H14
H13
H12
H11
H21
H22
H23
H24
FROM H13
FROM H12
FROM H11
FROM H24
FROM H23
FROM H22
DATA PACKET ENTERS MPLS DOMAIN
DATA PACKET EXITS MPLS DOMAIN
1006|43|IP|DATA
1005|43|IP|DATA
1007|43|IP|DATA
17|IP|DATA
117|IP|DATA
43|IP|DATA

FIG.1A

TO H11

INBOUND		IP ADDRESS	OUTBOUND		BPS	
I/F	LBL		I/F	LBL	I/F	LBL
–	–	289.29.74.08	2	17	–	–

TO H12

INBOUND		IP ADDRESS	OUTBOUND		BPS	
I/F	LBL		I/F	LBL	I/F	LBL
1	1006	–	2	1007	–	–

TO H13

INBOUND		IP ADDRESS	OUTBOUND		BPS	
I/F	LBL		I/F	LBL	I/F	LBL
3	1005	–	4	1006	–	–

TO H22

INBOUND		IP ADDRESS	OUTBOUND		BPS	
I/F	LBL		I/F	LBL	I/F	LBL
3	17	–	1	43	2	1005

TO H23

INBOUND		IP ADDRESS	OUTBOUND		BPS	
I/F	LBL		I/F	LBL	I/F	LBL
4	43	–	1	117	–	–
3	1007	–	–	–	–	–

TO H24

INBOUND		IP ADDRESS	OUTBOUND		BPS	
I/F	LBL		I/F	LBL	I/F	LBL
4	117	–	–	–	–	–

FIG.1B

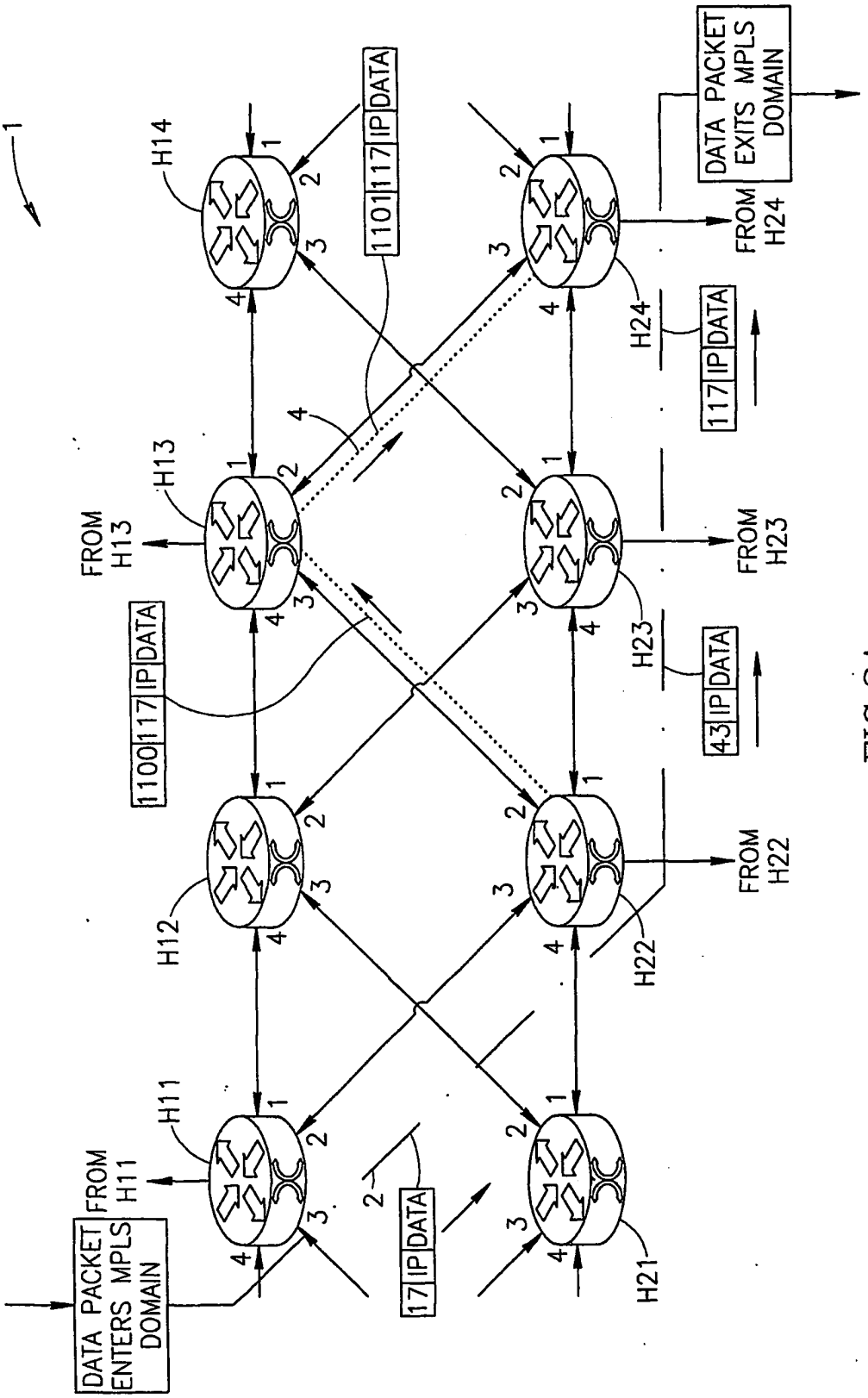
1
H14
H13
H12
H11
H24
H23
H22
H21
1101|117|IP|DATA
1100|117|IP|DATA
17|IP|DATA
117|IP|DATA
43|IP|DATA
DATA PACKET ENTERS MPLS DOMAIN
DATA PACKET EXITS MPLS DOMAIN
FROM H11
FROM H13
FROM H22
FROM H23
FROM H24

FIG.2A

TO H11

INBOUND		IP ADDRESS	OUTBOUND		BPS		
I/F	LBL		I/F	LBL	I/F	LBL	INT
–	–	289.29.74.08	2	17	–	–	–

TO H13

INBOUND		IP ADDRESS	OUTBOUND		BPS		
I/F	LBL		I/F	LBL	I/F	LBL	INT
3	1100	–	2	1101	–	–	–

TO H22

INBOUND		IP ADDRESS	OUTBOUND		BPS		
I/F	LBL		I/F	LBL	I/F	LBL	INT
3	17	–	1	43	2	1100	117

TO H23

INBOUND		IP ADDRESS	OUTBOUND		BPS		
I/F	LBL		I/F	LBL	I/F	LBL	INT
4	43	–	1	117	–	–	–

TO H24

INBOUND		IP ADDRESS	OUTBOUND		BPS		
I/F	LBL		I/F	LBL	I/F	LBL	INT
4	117	–	–	–	–	–	–
3	1101	–	–	–	–	–	–

FIG.2B

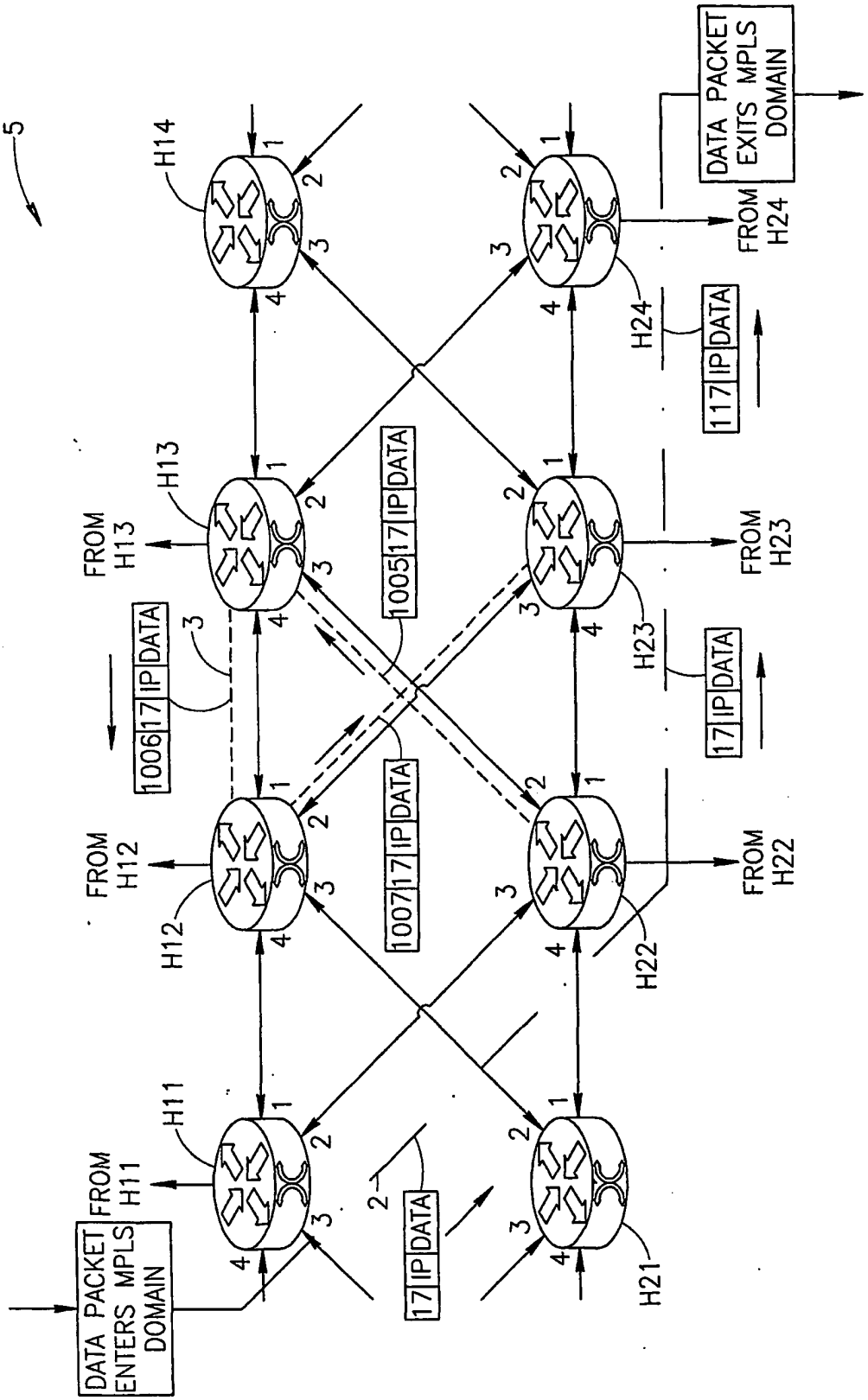
5
H14
H13
H12
H11
H24
H23
H22
H21
FROM H13
FROM H12
FROM H11
FROM H24
FROM H23
FROM H22
DATA PACKET ENTERS MPLS DOMAIN
DATA PACKET EXITS MPLS DOMAIN
1006|17|IP|DATA
1005|17|IP|DATA
1007|17|IP|DATA
17|IP|DATA
117|IP|DATA
17|IP|DATA

FIG.3A

TO H11

INBOUND		IP ADDRESS	OUTBOUND		BPS		
I/F	LBL		I/F	LBL	I/F	LBL	AI/F
–	–	289.29.74.08	2	17	–	–	–

TO H12

INBOUND		IP ADDRESS	OUTBOUND		BPS		
I/F	LBL		I/F	LBL	I/F	LBL	AI/F
1	1006	–	2	1007	–	–	–

TO H13

INBOUND		IP ADDRESS	OUTBOUND		BPS		
I/F	LBL		I/F	LBL	I/F	LBL	AI/F
3	1005	–	4	1006	–	–	–

TO H22

INBOUND		IP ADDRESS	OUTBOUND		BPS		
I/F	LBL		I/F	LBL	I/F	LBL	AI/F
3	17	–	1	17	2	1005	–

TO H23

INBOUND		IP ADDRESS	OUTBOUND		BPS		
I/F	LBL		I/F	LBL	I/F	LBL	AI/F
4	17	–	1	117	–	–	–
3	1007	–	–	–	–	–	4

TO H24

INBOUND		IP ADDRESS	OUTBOUND		BPS		
I/F	LBL		I/F	LBL	I/F	LBL	AI/F
4	117	–	–	–	–	–	–

FIG.3B

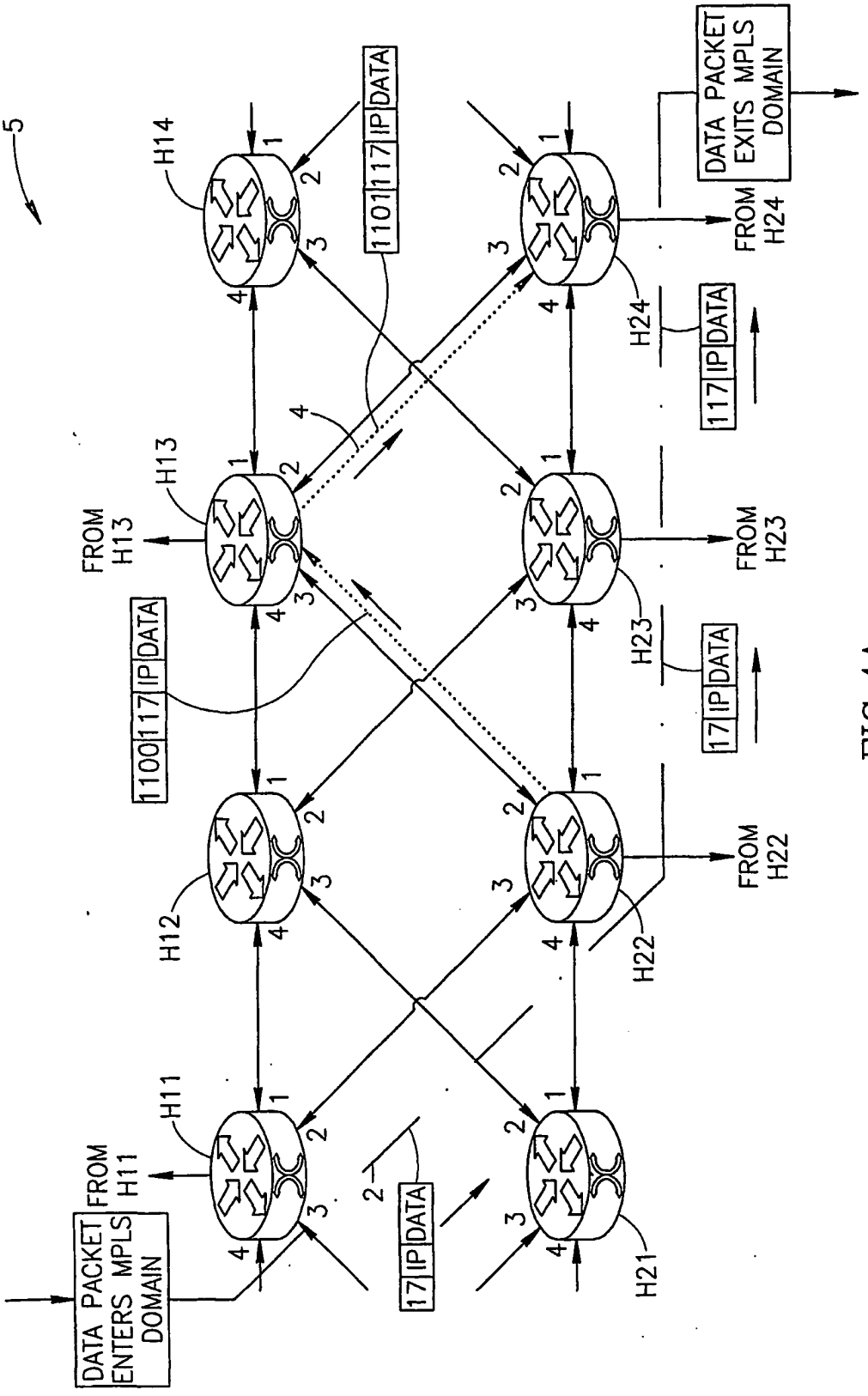
5
H14
H13
H12
H11
H24
H23
H22
H21
1101|17|IP|DATA
1100|17|IP|DATA
17|IP|DATA
117|IP|DATA
DATA PACKET ENTERS MPLS DOMAIN
DATA PACKET EXITS MPLS DOMAIN
FROM H11
FROM H13
FROM H22
FROM H23
FROM H24

FIG.4A

TO H11

INBOUND		IP ADDRESS	OUTBOUND		BPS			
I/F	LBL		I/F	LBL	I/F	LBL	INT	AI/F
–	–	289.29.74.08	2	17	–	–	–	–

TO H13

INBOUND		IP ADDRESS	OUTBOUND		BPS			
I/F	LBL		I/F	LBL	I/F	LBL	INT	AI/F
3	1100	–	2	1101	–	–	–	–

TO H22

INBOUND		IP ADDRESS	OUTBOUND		BPS			
I/F	LBL		I/F	LBL	I/F	LBL	INT	AI/F
3	17	–	1	17	2	1100	117	–

TO H23

INBOUND		IP ADDRESS	OUTBOUND		BPS			
I/F	LBL		I/F	LBL	I/F	LBL	INT	AI/F
4	17	–	1	117	–	–	–	–

TO H24

INBOUND		IP ADDRESS	OUTBOUND		BPS			
I/F	LBL		I/F	LBL	I/F	LBL	INT	AI/F
4	117	–	–	–	–	–	–	–
3	1101	–	–	–	–	–	–	4

FIG.4B

INTERNATIONAL SEARCH REPORT

Intern al Application No
PCT/IL 00/00446

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04Q11/04

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data, PAJ, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	VEITCH P ET AL: "ATM NETWROK RESILIENCE" IEEE NETWORK: THE MAGAZINE OF COMPUTER COMMUNICATIONS,US,IEEE INC. NEW YORK, vol. 11, no. 5, 1 September 1997 (1997-09-01), pages 26-33, XP000699938 ISSN: 0890-8044	1,5,9
Y	page 27, column 2, line 9 -page 28, column 1, line 27 page 30, column 1, line 37 -column 2, line 32 figure 6	2,6,10
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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

'A' document defining the general state of the art which is not considered to be of particular relevance

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'O' document referring to an oral disclosure, use, exhibition or other means

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'T' later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

'X' document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

'Y' document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

'&' document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
16 November 2000	30/11/2000

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Chassatte, R

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Intern al Application No
PCT/IL 00/00446

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
Y	SWALLOW GEORGE: "MPLS Advantages for Traffic Engineering" IEEE COMMUNICATIONS MAGAZINE, 1 December 1999 (1999-12-01), pages 54-57, XP002153023 page 55, column 1, line 28 - line 41 ---	2,6,10
A	ANDERSON J ET AL: "VIRTUAL PATH GROUP PROTECTION SWITCHING - A METHOD FOR FAST ATM NETWORK SURVIVABILITY" BELL LABS TECHNICAL JOURNAL,US,BELL LABORATORIES, vol. 2, no. 2, 21 March 1997 (1997-03-21), pages 213-232, XP000695177 ISSN: 1089-7089 the whole document ---	1-12
A	DOVERSPIKE ROBERT D. ET AL: "Future transport network architectures" IEEE COMMUNICATIONS MAGAZINE, 1 August 1999 (1999-08-01), XP002153024 the whole document ---	1-12
A	EP 0 961 518 A (NEWBRIDGE NETWORKS CORP) 1 December 1999 (1999-12-01) column 4, line 1 -column 5, line 38 -----	1-12

INTERNATIONAL SEARCH REPORT

...mation on patent family members

Intern al Application No
PCT/IL 00/00446

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0961518 A	01-12-1999	NONE	